NETWORK WORKING GROUP
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Richard W. Watson
SRI-ARC
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AN INTERACTIVE NETWORK EXPERIMENT TO STUDY MODES OF ACCESS THE NETWORK INFORMATION CENTER

1 Introduction

This NWG/RFC outlines the framework for a simple interactive experiment to study modes of access to the Network Information Center (NIC). A detailed specification for the initial access conventions to the NIC is contained in NWG/RFC #97, NIC (5740,). The initial online services to be provided by the Network Information Center are oriented around the SRI-ARC (ARC) Online System, typewriter version - NLS(T). These services will involve creation, manipulation, searching, and distribution of symbolic material (text initially). The initial Online System was display oriented and considerable development has gone into the study of features required for a comfortable interface to the user. In preparation for use with the Network Information Center, a typewriter oriented version has been developed. Assuming good computer response and a typewriter terminal operating at 30 char/sec, the system provides powerful and comfortable to use capabilities for handling structured textual material.

The question to which the experiment, to be described below, addresses itself is to determine how to extend these capabilities through the network to users at remote sites, possibly operating 10 char/sec and higher speed terminals through fairly heavily loaded systems. This experiment will also provide useful information about the interactive characteristics of the network, and guidelines for designers of other interactive systems to be used with the network. We propose that this experiment will be conducted with the assistance and cooperation of one other site. We estimate that the experiment will require about three calendar months. In order to minimize the resources required for the experiment, we will collect meaningful response time statistics that are easy to obtain with presently existing metering facilities in the SRI and cooperating site systems, and network performance measuring facilities. We will not conduct formal productivity studies with the users of the connection, but will obtain their subjective impressions on use of the various connection modes. The result will be data indicating the costs and benefits obtained using the types of access described below. We would expect that this information would be useful to sites in determining how they want to implement access to the NIC and other interactive sites.

During the period of the experiment, other sites will want to access the NIC as they come up on the network. We would recommend a simple approach, such as described in Section 2b, initially with a possible change later if the experiment indicates improved response and/or human factors coupling can be obtained with one of the other approaches. NWG/RFC #97, NIC (5740,) specifies this initial access approach in detail.

2 Getting Connected to the Network

2a Introduction

There are three basic approaches to allowing remote sites to connect to the NIC through the network, which we can call User Program Telnet, NLS(T) Front End, Monitor Telnet. Each of these is discussed below. Each approach requires code which will run in the remote host.

We assume that standard conventions for Telnet programs will be specified by the Network Working Group. In the companion paper (NWG/RFC #97, NIC (5740,)), we include recommended conventions on solving those problems which we are aware exist relative to initial NIC access, although we have tried to specify conventions useful more generally. The NLS(T) Front End Program would interface to the Telnet Program.

We assume that no matter which approach is taken, the software at the ARC end will use the information obtained during the connection process to log-in the remote terminal under a general account and will place the terminal user in the NIC version of NLS, which we will call NLS(NIC) for short. The NLS(NIC) will ask the terminal user for his initials. The remote user then has access to all NIC facilities.

The initial typewriter oriented system accepts commands of the general form

<command words> <operand> <delimiter> ... <operand> <delimiter>

The <command words> is usually two words, the first to initiate a general operation class, and the second to indicate a general data structure type to be operated on. The <operand>s specify specific data entities to be operated upon, or instructions to adjust NLS parameters.

The system at ARC is full duplex and allows the user to type the first character of the command words and the system immediately echos the remaining characters as feedback and support for the user. Other feedback is echoed where appropriate. The question we need to answer is what changes in this system will be required to suit it to the network and remote site constraints. We now look at problems existing at the remote sites.

To gain connection to the NIC we assume that the user logs into his local system and calls up a subsystem or cusp. This subsystem or system program, Telnet program, interfaces to the Network Control Program (NCP) and establishes the connection with the NIC. We assume this same Telnet program will be used to access other sites as well. The remote terminal and its controlling software system can operate in three basic modes as seen by the host subsystems:

Case 1 - Character at a time half duplex

Case 2 - Character at a time full duplex

Case 3 - Line at a time half duplex

Although line at a time full duplex is a logical possibility, no such approach is in general use and we ignore it in the following discussion.

In the discussions to follow, in Sections 2b, 2c, and 2d, we describe the modes of access which we would like to investigate

experimentally. We want to study user reaction with 10 char/sec, 15 char/sec, and 30 char/sec devices.

2b User Program Telnet

Consider the above classes of terminal in turn and the ways the Telnet program might handle communications between them and NIC. The Telnet program might allow both full and half duplex communication as specified by the user.

2b1 Case 1 - Character at a Time Full Duplex

The simplest approach would be for the Telnet program to take each character received from the terminal (except a special character or character sequence needed to escape back to the terminals host system), convert the code to ASCII and transmit it as a message to NLS(NIC). NLS(NIC) would handle all character echoing and transmit echo messages back to the Telnet for actual transmission to the terminal in the appropriate terminal code. This mode of communication involves full duplex transmission user to user and is probably the severest test of the interactive characteristics of the host-network-host system.

Depending on loading at the remote host, on the network, and at ARC, round trip delay for simple character echoing may be several seconds. Experience in communication between the old ARC 940 and a heavily loaded PDP-10 at Utah showed occasional delays on the order of 4 or 5 seconds and longer for single character echoing. Human factors considerations in use of NLS(NIC) indicate that such delays would probably be frustrating to the user. A more careful study of this mode of communication should give a base against which to measure the other modes of communication.

2b2 Case 2 - Character at a Time Half Duplex

There are two subcases which we treat identically:

i) The Telnet program sees a half duplex terminal.

ii) The Telnet program sees a full duplex terminal, but provides echoing so as to make the terminal half duplex as seen by NIC.

With the character at a time half duplex case the NIC program will operate in two modes:

a) short mode

b) long mode.

In short mode the user will type in the command and receive on his terminal only the characters echoed by his system and the NIC response to the command.

In long mode, the user will receive feedback from NIC at an appropriate point in the command. We want to see how novice and experienced users feel about working in these two modes, given the delays in the system response.

2b3 Case 3 - Line at a Time Half Duplex

From the point of view of the NIC this case is essentially the same as Case 2. From the point of view of the network this case is a more efficient use of the network as the messages are longer. This case is also more efficient for the user host system as it will require fewer calls to the Telnet subsystem; response for Case 3 may be better than Case 2.

2c The NLS(T) Front End

In this mode of communication, the subsystem which handles communication with the NIC is to perform some of the interactive and other tasks now performed by NLS(T). The type of tasks to be performed are echoing of the characters typed and the additional feedback characters for the full spell out of the command words, parsing of the command string, error handling where appropriate, and the sending of a parsed string as a message to NLS(T). If it should turn out that this mode of communication is the one preferred by sites, we would expect to supply an example version of the Front End program written in some language to serve as a model for implementation. The Network Working Group may want to give further study to a standard language for specifying such programs as indicated in NWG/RFC #51, NIC (4752,).

2d Monitor Telnet

Much of the response delay in the experiments of Section 2b is expected to result from the fact that the Telnet described there is a user program. We will run the experiments of Section 2b with the appropriate Telnet routines resident as a part of the user host monitor.